Metron 2 Technical Manual and Specification

Revision 2.4a

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1 General Information and Safety

1.1 Document Revision History

Revision	Date	Notes
V7.1.5.0.9	12/01/2012	Revised to suit latest firmware revision (0.6.0.3) & hardware variations
V2.0	7/1/2013	Combined all documents, new revision of user manual ready for print
V2.1	21/1/2013	Minor corrections / updates after review
V2.2	04/10/2013	Various corrections made
V2.3	31/03/2014	Various corrections made
V2.4	08/04/2014	Various corrections made

1.2 Proprietary Notice

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1.3 Safety

Read carefully these instructions and notes before powering your Metron2. For each situation please follow the specific instructions.

The Metron2 is a low power radio transmitter and receiver. When it is powered, it will send and receive radio frequency (RF) signals.

Operating the Metron2 close to other electrical equipment such as television, phone, radios and personal computer, may cause interference.

Interference - The Metron2, like all wireless devices, is subject to interferences that may reduce its performance.

Road Safety - Do not use the Metron2 while driving. In case of use on cars, it is necessary to check that electronic equipment is shielded against RF signal. Do not place the Metron2 over the air bag or in the air bag deployment area.

Hospital Safety - Do not use the Metron2 near health equipment, especially pacemaker and hearing aids, to avoid potential interferences. The Metron2 is a not mobile phone; do not use it in direct contact with the human body. Switch it off in hospitals, and in any other type of medical centre. Hospitals or health care facilities may be using equipment that could be sensitive to external RF energy.

Explosive Materials - Do not use the Metron2 in refuelling points, near fuel or chemicals. Do not use the Metron2 where blasting is in progress. Observe restrictions, and follow any regulation or instruction.

Do not use the Metron2 in direct contact with the human body; do not touch the antenna if not necessary when the Metron2 is powered. Use approved accessories and batteries only. Do not connect incompatible products.

1.4 Battery Information and Safety

The Metron2 is available with an integral battery.

- Do not use if the battery casing appears damaged
- Do not attempt to recharge the battery
- Do not short circuit
- Only use supplied battery with the Metron2

The battery is a high energy density sealed battery containing dangerous (Lithium) and deleterious (Thionyl Chloride) materials. For this reason, improper handling of the battery could lead to distortion, leakage, overheating, explosion, fire, or generation of irritating/corrosive gases, causing bodily injury or equipment trouble. Please observe the following instructions to prevent accidents.

Do not use if you suspect any damage to the casing, cabling or connector.

Do not connect to a Metron2 when the programmer is connected.

Be careful not to drop – if dropped please do not use.

Do not short circuit the battery – if you suspect this possible then disconnect and do not use.

Do not apply heat to the battery.

Do not expose the battery to open flames.

Never disassemble the battery.

Never deform the battery.

Do not reverse polarity the battery – take extra care to ensure connections are the right way round.

Do not connect 2 or more batteries together.

Do not store the batteries in direct sunlight.

Store batteries in non-conductive trays (e.g. plastic, wood or cardboard).

Do not use near water.

Do not have rings on your fingers when handling batteries, otherwise wear insulating gloves.

First aid measures

Only in case of contact with internal components of the battery:
Skin contact: flush with plenty of water
Eye contact: flush with plenty of water (eyelids held open)
Inhalation: breath fresh air and give oxygen or artificial respiration by specialist people
Ingestion: drink plenty of water and consult a doctor

Fire fighting measures

Evacuate the building and leave it to the professionals. Advise the fire fighters that there are batteries in the building and the advice is to use extinguishers type D, Lith-X, DO NOT USE WATER in case of battery leakage
Special hazards: irritating vapour
Special protective equipment: wear protective clothing, use self-contained breathing apparatus with filtered cartridge type ABEK

Leakage measures

In case of break of a battery, all the people must go away from the place where the incident happened and come back only after the dissolution of the irritating gas.

Broken batteries or battery packs must be covered with sodium carbonate (Na2CO3) or dry sand, place them in approved container and dispose in accordance with local regulation.

Disposal

Please return batteries to Powelectrics for disposal. Ensure suitable packaging in used. Do not use air freight.

Replacing the Battery
The battery used in the Metron2 must be supplied by Powelectrics Ltd. Its warranty will be void if any other battery is used as it may damage the Metron2 or cause it to malfunction. To remove the battery, undo the Velcro strap

1.5 Components supplied

The Metron in its standard form comes with a number of standard parts. If you are an OEM customer, we may supply you with a variation on this.

- Metron 2 cardboard box
- Metron 2 Unit
- 4 x M12 Cable Glands (one fitted) with O rings
- 5 or 6 x M12 Blanking plugs (two fitted) with O rings depending on model
- 1 x Breather gland (fitted) with O ring

1.6 Definitions / Glossary

Modem – This is the part of the Metron 2 that allows external communication (sending of data and text messages).

GSM – Global System for Mobile communications – This is the standard that the modem in the Metron 2 uses to communicate.

Carrier / Network – This is the network operator or service provider, e.g. AT&T or Vodafone

Volt Free Contact – A simple contact or switch that is either on or off.

Sensor – This is a part that measures a specific parameter, environmental condition

Cell ID – The specific cell that the Metron 2 is connected to. It can be used for approximate location.

Booting – The process that occurs to switch on the modem. This normally takes less than one minute

Unit – The Metron 2 may be referred to as the unit in some sections

Programming – Configuring the Metron 2 may be referred to as this

RTU – Remote Telemetry Unit, refers to the Metron 2

1.7 Part numbers

Part number	Description
METRON2/S	4 analogue inputs, 6-24Vdc power supply
METRON2/SSM	4 analogue inputs, integral 3.6 volt battery
METRON2/S/2RE	4 analogue inputs, 6-24Vdc power supply, 2 relay outputs
METRON2/SSM/2RE	4 analogue inputs, integral 3.6 volt battery, 2 relay outputs
CPS758	Battery (3.9 volt, 16AH, non-rechargeable)

1.8 Symbols

Symbol	What it means
	Indicates that this is important information and should be adhered to
	Indicates that this is very useful information and is essential to understand the Metron 2

2 Introduction to the Metron 2

2.1 How to install, setup and commission the Metron 2

If you are new to the Metron 2, the following basic process must be followed:

1. Read through the remainder of the introduction to the Metron 2
2. Mechanically mount and understand how to seal the Metron 2 (section 3.1)
3. Electrically wire in the Metron 2, observing requirements (section 3.2)
4. Fit SIM card
5. Understand and then configure the Metron 2 (section 4)
6. Follow strictly the commissioning guidelines (section 4.10)

If you are experiencing problems with the Metron 2, please refer to the troubleshooting guides and FAQ. If you still require support, please look at the checklist below (2.2) and contact your distributor, or Powelectrics if purchased directly.

2.2 Requirements for Technical Support

Please note that if you wish to contact us for technical support setting up a unit, before we can help you we will need some information from you.

Necessary:

- Serial Number
- SIM card information
- Access to the unit and its physical location
- What you would like the Metron 2 to do
- Information about the sensors or inputs into the Metron

Ideally:

- An exact configuration you would like
- A laptop or computer with the software running
- A mini USB cable
- A multi-meter
- Specific part numbers for the sensors or inputs to the Metron
- A SIM card that you have sent a SMS message from using a normal phone (important!)

2.3 Overview

This document describes all the functions, features and interfaces of the Metron2 telemetry device.

Applications

A few of the applications that this device has been designed for include:

- Remote Tank Level Monitoring
- Environmental Monitoring
- Meter Reading
- Condition Monitoring
- Alarm Reporting

Summary of Technical Features

- Ability to interface with up to four analogue (0-10V or 4-20mA), digital (ON/OFF)
- On-board excitation, ~3.6 volts (non-regulated), 5 v, or 21.6 volts (max 31.25mA)

- Internal battery powered with a long life, or external 6 to 24 V DC power source (0.5 amps).
- Back lit LCD Display, 40 x 40mm, 128 x 128 pixels, to help with on-site setup & diagnosis
- Quad-band operation
- USB port for programming & firmware upgrade.
- Expansion board socket for future use.

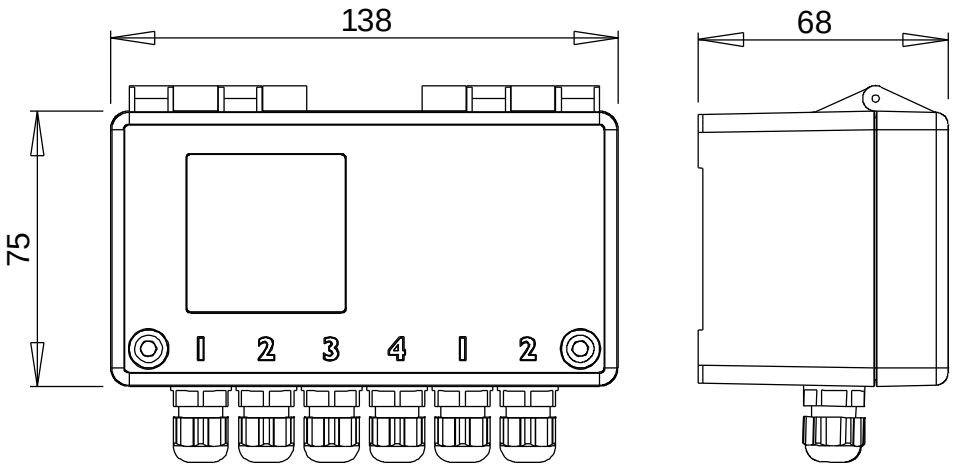
As the Metron2 is normally a battery powered device it has been designed in such a way to extend this life to a maximum. This means during normal operation the display will be off, the sensors excitation will be off and the GSM engine will be powered down. As required these are switched on by the processor and when finished with they are switched off. If the unit is powered from an external source then the unit can be configured so that the GSM engine is always on.

2.4 Specification

General	Number of input channels	4
	Connectors	4 x 3 Pin 3.81mm Pitch for Sensors, 1 x 2 PIN for power
	Warranty	24 Months RTB. Does not cover above or incorrect installation
Enclosure	Environmental	IP67 Rated
	Dimensions	125 x 75 x 65 (mm)
Communications	Operating Frequency	850/900/1800/1900Mhz
	Output power	Class 4 (2W) 850/900 MHz
		Class 1 (1W) 1800/1900 MHz
Electrical	Power Supply (IN)	3.6, or 6 to 24 V DC @ 0.5A – please ensure supply is smooth. Check the type of Metron2 you have.
	Excitation Supply (To sensors)	3.6 v (unregulated), 5 v or 21.6 v. 31.25mA maximum
	Input types	Digital or Analogue
Analogue input channels	Resolution	10 bit (1024 Increments) across 10 volts
	Accuracy	0.25%
Antenna		Internal or external (via SMA connector)
Display	40 x 40mm, 128 x 128 pixels	Backlit
General	Number of input channels	4
	Connectors	4 x 3 Pin 3.81mm Pitch for Sensors, 1 x 2 PIN for power
Expansion Card	Number of input channels	5
	Input type	Digital or Pulse
	Maximum pulse frequency	10Hz

3 Installation instructions

3.1 Mechanical installation



All dimensions in mm.

Open the lid to reveal the 2 mounting holes. These should be used to fasten the Metron 2 down to a baseplate, wall or other surface. To access these two holes, you may have to remove two M12 blanking plugs. These must be replaced.

The two screws on the front of the enclosure should not be over tightened – otherwise it is possible to break the watertight seal by tearing or deforming the ‘O’ ring below the head of each screw.

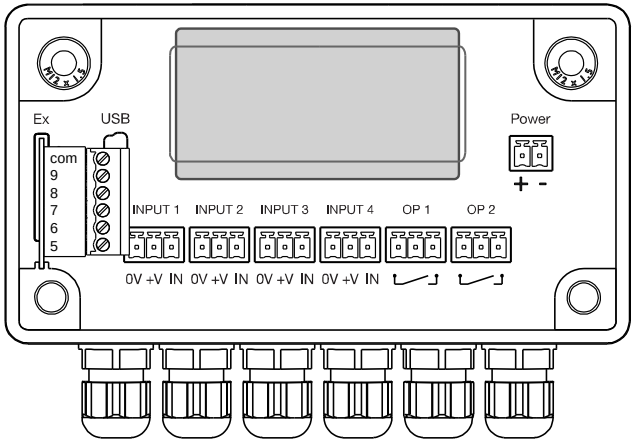
The unit needs a mobile phone signal to work – the stronger the signal the better so try and avoid mounting inside metal cabinets or underground. Mounting it on the outside of a metal container may help improve the signal, depending on the direction and location. Use the ‘Get config / signal’ feature to find the optimum location first.

Weatherproofing Information

It is essential that the following is checked if being used outdoors

- All cable glands and breather glands on the unit should have an ‘O’ ring fitted and are sufficiently tightened
- Both screws on the top are tightened, but not over tightened
- The seal around the lid is correctly in place

3.2 Electrical installation



3.2.1 Power supplies and consumption

Your choice of power source needs to suit your application. You can use an internal lithium battery (not rechargeable) but for now you must use an external 5 to 24 Vdc power source (could be solar, wind, a larger battery, or a 110/230 Vac to 6-24Vdc power supply). The supply needs to be quite well regulated and capable of delivering a peak of 0.5A.

Important: only configure the unit to operate in power states 1 (GPRS pollable), 2 (SMS pollable) or 3 (transmit on power up). Power state is part of the system command.

The power consumption will vary depending on how the unit is programmed. If Powering from the internal battery then be sure to configure the 'modem power scheme' as 'power off between transmit events.'

When 'asleep' the device will draw approximately 85 micro amps.

Please note that the battery capacity quoted by the manufacturers is not always fully available to the Metron2. Please consult Powelectrics for advice on how long the battery will last in your application.

The current consumption varies depending on the state of the unit. The figures below are based on a power supply between **3.6 to 4.2 volts.**

Deep sleep	85 micro amps (screen, sensors and GSM modem off)
Screen on	add 28mA
USB connected	add 8mA
GSM on (in 'polling' mode)	add 24mA (typically)
During analogue read now	add 50mA average – depends on settling time per sensor but allow at least 5 seconds

The device will not function correctly if the supply voltage is between 4.2 and 5 volts.

If the supply voltage is greater than 5v there is additional components are in use within the Metron2 and it therefore draws 2mA in 'deep sleep' mode. If you intend to use in an application where the power demand is too great for the integral battery option (Metron2/SSM) then you will need to consider this and select the supply accordingly.

When the unit is communicating over GSM/GPRS the current consumption fluctuates over time and varies depending on the signal strength. The length of time the communications takes depends on how long it takes to charge the on board super-capacitors, how long it takes to register onto the network and how long communications takes (with GPRS communications t is up to the host to 'kill' the connection).

Battery safety is important. The CPS5758 has a very high power density and needs to be treated with care. It is possible to find lower cost alternatives but these are unlikely to include suitable fusing and ventilation and should not be used

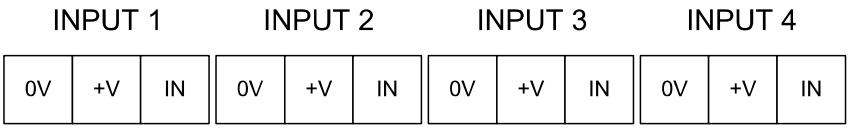
After each transmission the Metron2 stays connected to the mobile phone network for 45 seconds providing time for SMS messages to be received should they have been sent to reconfigure the unit.

Source	**Notes**
5V USB power supply	USB cable needs to be spliced. Red = Positive (+), Black = Negative (-). Only use very high quality supplies that can provide 500mA or greater. Cheap, non-genuine versions commonly cause problems and damage to many products.
5 – 24V open frame or DIN rail mount power supply	Double check polarity before powering on. Mains wiring must be carried out by someone who is suitably qualified. High quality switch mode or linear supplies should be acceptable.
6 – 24V lead acid battery (trickle charged)	Extra care should be taken while wiring and a separate external fuse should always be used.
Lead acid battery charged from alternator	Often the charging method means that the supply will not be smooth (from an alternator or generator for example) and can cause problems. A maximum of a 24V system is allowed.
3.9V Lithium battery	Only use Powelectrics supplied battery.
3.6 – 4V power supply	Not recommended. Do not use this method.

3.2.2 Sensor types and Input wiring

Run the cable through the glands & tighten. Unplug the green connectors and wire in as required. Ensure unused glands are replaced with blanking plugs to prevent water from getting inside the unit.

Each input channel has its own plug and corresponding socket. On each socket, three connections are available.



0V: This is the 0V / -Ve connection for the channel, although they are all common to each other.

+V: This will provide the supply voltage to the channel, also known as the excitation voltage. This is configurable to either 21.6V, 5V or 3.6V (un-regulated). It is important that the load on this does not exceed 31.25mA.

IN: This is the input for the channel, also known as 'signal.' This will accept 0-10V or 4-20mA.

Note: It is important that the channel used for the sensor excitation and the sensor inputs are the same.

0 – 10V output (three wire)

This sensor type will typically have a greater than 14V input, while the output will vary between 0 and 10V depending on the readings. Generally, but not always, these use less power than the same sensor type with a 4-20mA output.

0 – 5V ratiometric (three wire)

The sensor will be supplied with 5V (+/- 2.5%) – with this the sensor feeds a proportion of the voltage back to the input. Usually this type requires very little power.

4 – 20mA loop (two wire, +V and IN)

The sensor is measured using a current loop. This means that the total power consumption of the sensor varies between 4 and 20mA depending on the measurement of the sensor. The benefit of using a current based output is that it is generally more immune to external interference than a voltage output.

4 – 20mA or 0 – 20mA powered (three wire)

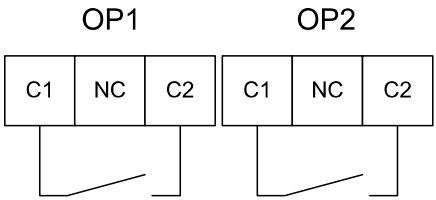
This type is powered from a separate supply and the output varies depending on the measurement of the sensor. This type of sensor is usually used when the minimum current requirement exceeds 4mA meaning a two wire system is not possible.

Switched input / Volt free contact (two wire, +V and IN)

This is simply a switch – the contact will be supplied with 3.6V from the +V contact. The input will monitor the state of the switch using this wetting voltage.

Other – Please contact Powelectrics with any other sensor type

3.2.3 Output wiring



The two outputs are the two right hand side three way connectors. The internal relays for the outputs are optional and are not supplied in the Metron as standard, though the connectors will still be present.

The outputs should not be used for switching high voltages (mains voltages). They are each rated to switch 2A at 30V DC.

3.3 SIM cards and Carriers

SIM card selection is often the cause of connectivity issues. There are a number of requirements needed from the SIM card for it to operate correctly

- It is the correct type (full size SIM, not micro or nano SIM)
- It does not have a PIN enabled on the SIM
- There is network coverage where you plan to use it
- Roaming is enabled if using outside of the country of purchase
- The APN, username and password for the SIM contract are correct.

Replacing the SIM

1. Open the lid to reveal the SIM card holder.
2. Note the orientation of the SIM socket, using the drawing behind the socket
3. Slide the SIM into the socket
4. If the installation is going to be moving or vibrating, you may wish to use a piece of high-tack tape across the back to prevent the SIM from moving in these conditions

Manually selecting a carrier

If you are using a roaming SIM that is capable of using multiple carriers in the installation location, then you may want to select a specific carrier to use by default. This may also be especially useful if there are two weak differing networks in the area and the unit switches between them frequently. To do this, follow these instructions.

1. Verify if you have a roaming SIM. Do not proceed if you do not.
2. Go to the menu option ‘System’ and then ‘Carrier Select’
3. It will take a little while to boot the modem if necessary and query the networks
4. A list of operators that are available in the area will appear. It does not mean you will have permission to connect to them all.
5. Select the operator that you wish to use in the future.

If the unit is not able to connect to the carrier that you have selected next time, it will fall back to automatic selection.

3.4 External Antennas

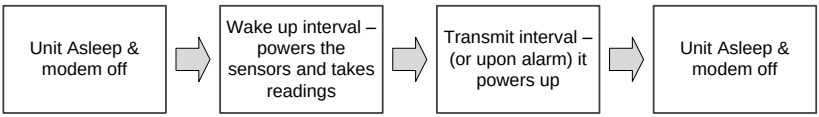
The Metron2 has an integral antenna. The system has been designed to gain optimum signal strength to the mobile phone network but it is possible to use an external antenna. If you are in an area of poor signal strength, or mounting the unit inside a metal enclosure then you may need to connect an external antenna. If using an external antenna then select this option when programming or use the menu option to enable.

Special fittings for the external antenna

The SMA connector that is present on the board usually requires a mating connector that is too large to fit through the standard M12 cable glands that are supplied. We can provide a M12 to M16 gland adaptor that allows fitting of this.

4 Using the unit and commissioning

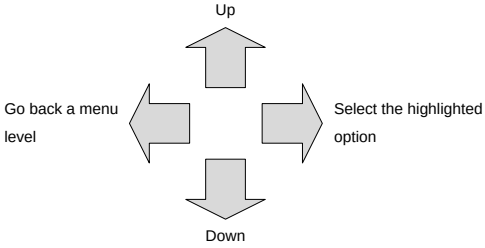
4.1 How it works



The wakeup interval and transmit intervals operate independently. So it is possible to wake up and check the sensors many times per day, but only transmit far less frequently.

Between each wake up interval and each transmit interval, the unit is effectively shut down to minimise the power required. During this time, no communication (SMS or GPRS) will be possible to or from the unit. The only exception to this is if you have configured polling mode, where the modem is continuously powered.

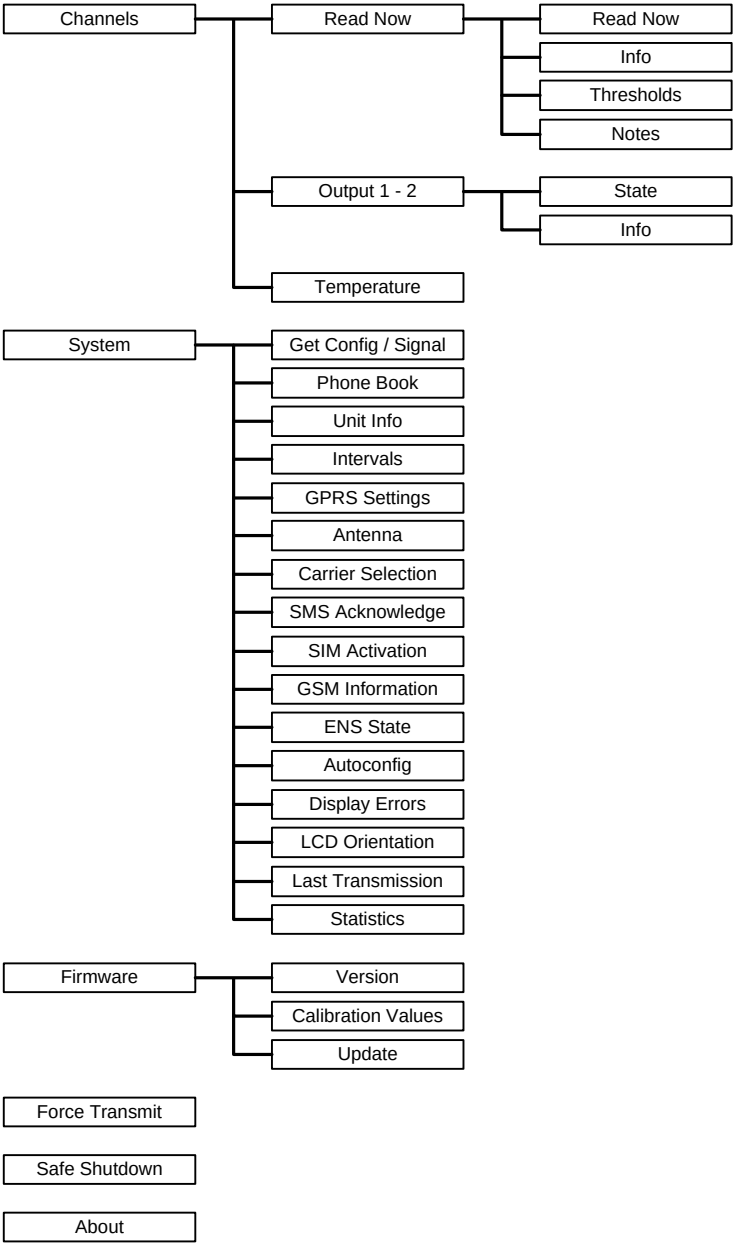
4.2 Using the menus and buttons



Use the arrow buttons on the front of the display to navigate the menus. When wanting to leave a menu selection, or return to the previous menu, you will need to press and hold the left button.

Multi-tasking - The Metron2 can only do one thing at once, and there are times when it may be taking actions in the background. For example if you have Idle set to 1 in the 'system configuration' command then at power up the unit will be setting up the gsm modem in order to make it pollable and you may find it is a little slow to respond to any button presses.

4.2.1 Menu structure and functions



Option	What it does
Read Now	This allows the sensor to be powered up and read. A number of other real time measurements will be read out which will help setting up the sensor (Vo = Voltage Out, Vin = Voltage on input, Iin = Current on input, A/D = raw analogue to digital value)

Info	Displays the various settings relating to the input selected
Thresholds	Displays each of the high and low thresholds that has been set on the channel
Notes	Displays any notes that have been set on that channel
State	Displays the current state of the output
Info	Displays the current configuration of the output
Temperature	Displays the Internal temperature of the Metron 2
Get Config / Signal	Powers on the modem and checks for SMS messages. Waits for 60 seconds after powering on. Also shows the network / carrier that it is connected to and the signal quality. The signal quality is a value from 0 to 31, with 31 being the best and zero being the worst. We recommend a signal of 10 or better for GPRS connections.
Phone Book	Displays the phone numbers that are programmed into the device
Unit info	Displays most of the system programmable parameters
Intervals	Displays the timings that have been programmed
GPRS Settings	Displays the GPRS settings on the unit
Antenna	Allows selection of the internal or external antenna to be used. This setting cannot be changed remotely and must be set using this option.
Carrier Selection	This option boots the modem and performs a carrier scan. It then presents the list of available operators to choose from. Selecting one causes it to attempt to connect to that carrier in the future, though does not guarantee success.
SMS Acknowledge	The SMS acknowledge option, if enabled, means that each SMS received will have a SMS sent to the originating number. This message will either confirm successful receipt of the message or a description of the problem with the message. When the unit goes back into run mode (LCD off), this will be automatically disabled.
SIM Activation	Allows the modem to be kept powered for a fixed period of time – this is useful when SIM cards need to be activated.
GSM Information	This shows various information about the network and SIM card.
ENS state	ENS is ‘Enhanced Network Services’. This is not normally required and should be left disabled unless problems with roaming SIMs are found.
Autoconfig	This allows the ‘autoconfig’ flag in the Powelectrics protocol to be set to on, indicating a configuration is required.
Display Errors	Makes all errors visible on the LCD when encountered, including non-critical issues. This can be especially useful when troubleshooting connectivity problems.
LCD Orientation	If you wish to mount the unit at a specific angle, you can adjust the orientation of the screen here.
Last Transmission	Displays various information relating to the last transmit, such as data transmitted and received.
Statistics	Displays a lot of statistics about the unit. Some of these statistics are not used.
Version	Shows the version number of the firmware, MCU revision and other various details
Calibration Values	This shows a complete list of the factory set calibration values
Update	Used to enter the USB boot loader mode
Force Transmit	This will initiate the transmit process. It will give an error if the unit does not have enough settings entered to complete the process.
Safe Shutdown	If the unit is in polling mode, you should use this option before disconnecting the power
About	Displays information about the Metron

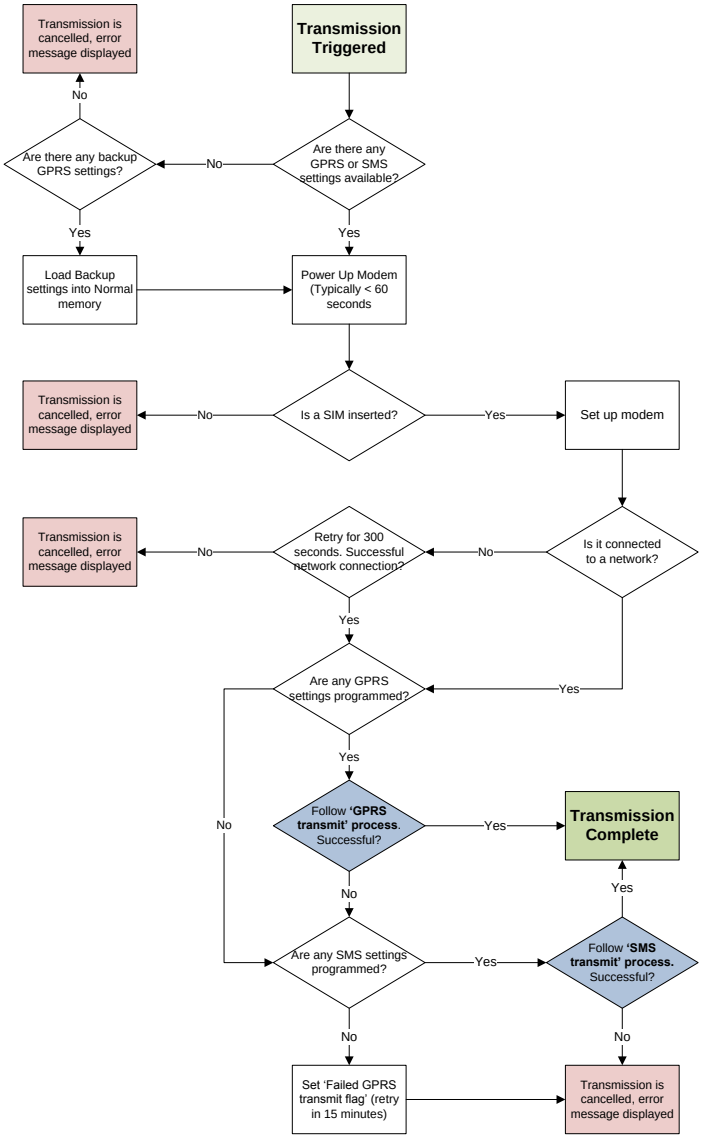
4.2.2 Outline of operational modes

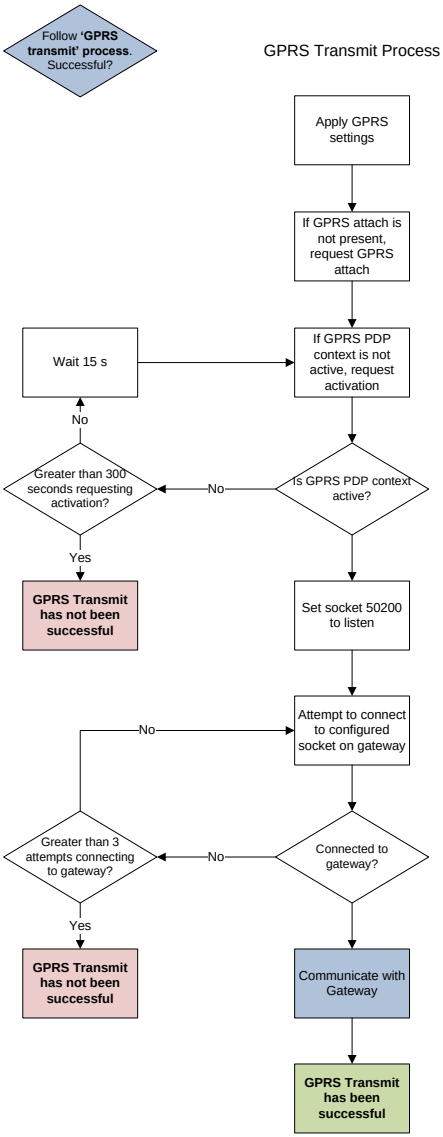
There are four modes that can be configured for the Metron 2 to run in – these change how the Metron 2 behaves between transmits and when it is connected to the GSM network. It is configured under the 'system' tab using the config tool or using the ,2, (system) command if configuring manually.

Mode	What it does
Power off between transmit events (0)	The modem will power down between transmit intervals. During this time it will be unable to receive any SMS messages, GPRS communications or connect to any network.
Always on (GPRS Pollable when idle) (1)	The modem will idle between transmit intervals and be pollable using GPRS. Unit auto detects if internal battery is used and will default to 0 if this is the case to optimise battery life. It will be able to receive both SMS messages and GPRS communications and it will always be connected to a network.
Always on (SMS Pollable when idle) (2)	Modem will idle between transmit intervals and be pollable using SMS only. No GPRS capable SIM is required for this to work correctly.
Transmit on Power up (then to SMS Pollable) (3)	Modem will idle between transmit intervals and be pollable using SMS only. No GPRS capable SIM is required for this to work correctly. It will also initiate a transmit upon power on. This may be useful as an indicator of when the unit loses power

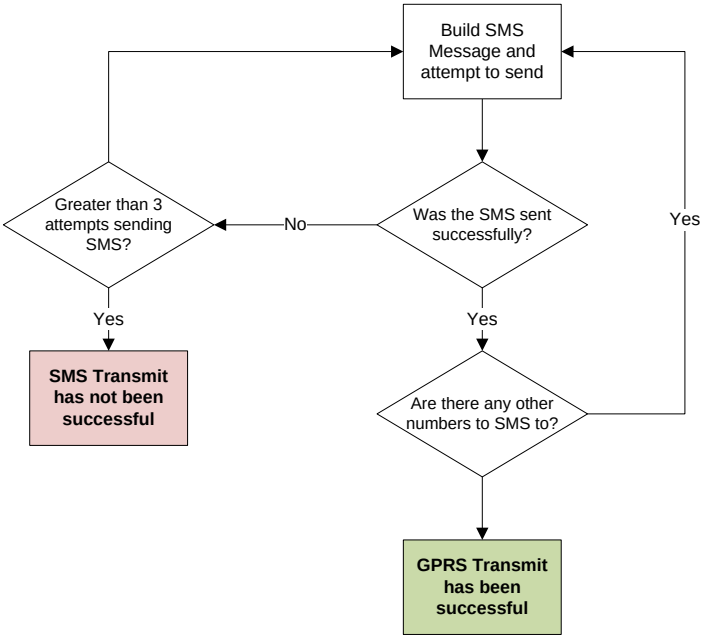
4.2.3 Transmission Process – Flow Chart

Both the log and alarm process follow the same process for transmission. The blue diamonds are complete processes that can be found separately.




Follow 'GPRS transmit' process. Successful?
GPRS Transmit Process
Apply GPRS settings
If GPRS attach is not present, request GPRS attach
Wait 15 s
If GPRS PDP context is not active, request activation
No
Greater than 300 seconds requesting activation?
No
Is GPRS PDP context active?
Yes
GPRS Transmit has not been successful
Set socket 50200 to listen
No
Attempt to connect to configured socket on gateway
Greater than 3 attempts connecting to gateway?
No
Connected to gateway?
Yes
GPRS Transmit has not been successful
Communicate with Gateway
GPRS Transmit has been successful

SMS Transmit Process



4.2.4 Meanings of Icons

Icon	What it means
	Going into polling mode
	In polling mode
	Failed to get into polling mode. Waiting for 15 minutes before retry
	In polling mode but temporarily disabled because user is using the menu
	USB is connected
	Device is in SIM update mode. This means the modem will be kept powered on for a fixed period of time, in case you are waiting for a SIM update to come through.
	This is the signal strength indicator. This ranges from five flat lines (no signal) to 5 bars increasing in height.
	This replaces the signal strength indicator when the modem is switched off. It means that the modem is fully powered off and that no communications to or from the network can currently be made.

4.3 Important notes about how the Metron 2 operates

SIM updates

If the unit is in polling mode then it will automatically receive sim updates. Options are available from the system menu to force the unit into a sim update mode for varying lengths of time, as well as the facility to view the log of received updates (though please note these messages are inconsistent and cannot be relied upon – please refer to your network provider to verify if relevant updates have been delivered to the device.

Timekeeping

The Metron 2 has 3 potential time sources. The first is manual setting of the time – this can be set using the config tool under the tools menu and 'set clock to PC time'. If you wish to set it using a command (locally or remotely), see the ,0, command in the 'configuration commands guide'. The second method is using NITZ – this is when the network provides the time for you. It is only supported on some networks, so it cannot be relied

upon if many different networks are used. The third method is being set by the GPRS gateway you are connected to. The GPRS gateway will always take priority over other methods if set.

Network selection

There are two factors that influence the network selection

- If you have chosen 'carrier select' and have actually selected a network to operate on. When in this mode, it will attempt to connect to the network that you have selected when powering on the modem. If it is unable to connect for any reason, it will fall back to the automatic selection that is dictated by the SIM card.
- The SIM card – This has a table (the PLMN table) built in that dictates which networks it is allowed on. In automatic mode, it will follow whatever data is present in the table.

4.4 Types of Digital Inputs

Normal

This sampling method occurs when you have at least one channel configured as analogue input in addition to at least one digital. It will wake up at each wakeup interval and sample both analogue and digital inputs in the same way a normal analogue input is sampled. This will take a longer period of time, so battery life must be considered if checking very frequently (once per minute for example).

Quick

If only digital inputs are configured then it will use this sampling method. Every wakeup interval it will very quickly sample the state of each input, taking a few milliseconds per input. Because of the dramatically reduced sample time it will use far less power if sampling frequently.

4.5 Before you start

Please make sure you have the following to hand

- 4mm Allen key
- A SIM card with at least the ability to send a text message (see 3.3)
- A battery or appropriate power source (see 3.2.1)

4.6 General

With the power connected press either the right or the down button to 'wake the unit up.' Enter the PIN (default = 1234) followed by the right arrow. Navigate around the menu. Use the menu to check signal strength, look at inputs, check the configuration and much more. Some of the common uses for the display are:

Checking the signal strength (System > Get config / signal)

Select external antenna (System > Antenna

Checking the readings from the sensors (Channels > Channel # > Read Now)

Rotating the display (System > LCD Orientation)

The complete list of functions available through the menus can be found in section 4.2.1

4.7 Configuration

There are three methods that can be used to configure a Metron 2. These are:

- Local configuration using a computer and USB connection (recommended)
- Using SMS messages
- Remotely via GPRS (requires a pre-existing and functioning config)

All three methods are based around the same command structure that can be found in the separate guide 'Configuration commands specification'. The recommended method for sending these commands is to use a USB connection and the Metron 2 config tool (software that runs on your computer).

4.8 Configuration tool software

The following guide shows the recommended method of configuring the Metron 2, using a computer and USB connection. It is strongly advised to follow this method unless you are very familiar with the Metron 2.

4.8.1 Installation of the config tool and driver

NOTE: YOU CANNOT USE THE MENU ON THE METRON 2 TO CONFIGURE THE DEVICE - YOU HAVE TO EITHER CONNECT VIA USB OR SEND IT TEXT MESSAGES

Please download the installer package from the Powelectrics website or request it from sales@powelectrics.co.uk

1. Run the installer file that you have been sent or downloaded
2. Follow the instructions – a shortcut on the desktop will be created on the desktop when installed
3. If installing a newer version of the installer, there is no need to remove the old one first.

Installing drivers

If using the Metron 2 with a new laptop for the first time

1. Open device manager (go to start menu and search for 'device' in the text box)
2. Power on Metron
3. Plug in USB cable
4. It should appear as a new device (usually SERIAL DEMO or similar).
5. Wait for 30 seconds or until loading light on your laptop has stopped flickering
6. Right click on the 'Serial Demo' device and choose update software
7. Follow instructions and if asked, choose the option to select the driver to install
8. Choose the driver in 'Program Files/Metron 2 Config Tool/drivers' folder

Troubleshooting when using config tool

If you are experiencing any connectivity issues, follow this procedure

1. Disconnect USB, power to the Metron and close the Metron 2 config tool
2. Double check that there are no other copies of the Metron 2 config tool running
3. Plug in power
4. THEN plug in USB
5. THEN load the Metron 2 config tool, pressing 'Scan for Ports' once loaded.

4.8.2 Using the config tool

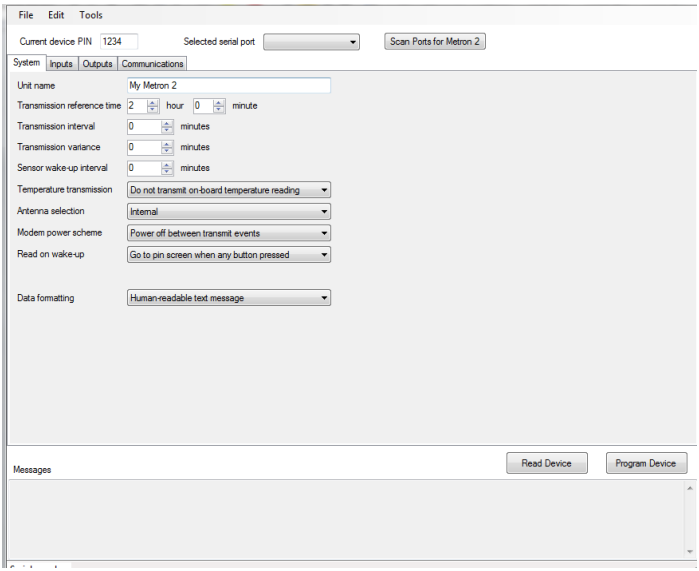
You should only run the config tool once you have plugged in the Metron 2 while powered on and have successfully installed the driver (see 4.8.1). Double check that there is not more than one copy of the Metron 2 config tool running at any time – it will not work correctly if multiple copies are accidentally run.

After loading the config tool, you will be presented with the home screen with the system tab selected. The first thing to do is establish the connection to the Metron 2 by pressing ‘Scan Ports for Metron 2’. If you encounter problems, please refer to the troubleshooting guide.

The config tool is split into four separate tabs that control the various aspects of the Metron 2. You should start at the leftmost tab and work to the right.

The buttons ‘read device’ and ‘program device’ allow the configuration to either be read from the Metron, to replace the parameters listed in each box, or send each parameter in each box to the Metron. When you are satisfied with the configuration, using the ‘file’ menu on the top left allows you to save the complete configuration from all available parameters as a single file (.csv file).

System configuration



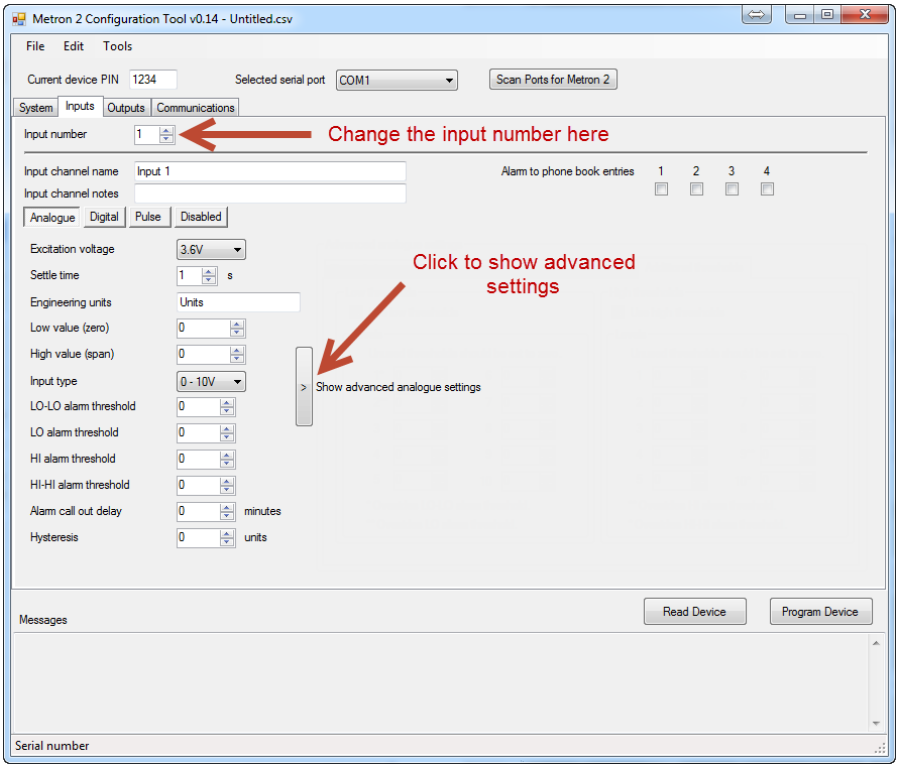
For each tab there is a breakdown of configurable options in the following section.

Option	What it does
Unit Name	This is the name of the unit – it should ideally uniquely identify it
Transmission reference time	This is the time of the day that it will synchronise and transmit using. The hours should be entered in the 24 hour format. The unit may take up to 24 hours for the transmit intervals to synchronise to this time.
Transmission interval	How often in minutes the unit will take readings and then transmit them. If set to zero unit will transmit every day. If not evenly divisible into 24 then unit resets at the time defined by the HH MM / variance part of this command. Unit will not transmit if the user is working with the menu.
Transmission variance	The variance of the transmit time each day – e.g. If this is set to 60, it will randomly select a time + / - 30 minutes of each transmit hour and minute for transmission. Must be less than the transmit interval
Sensor wake-up interval	How often in minutes the unit will power the sensors and take a reading. Applies only to analogue inputs. Unit will not take regular readings if the user is working with the menu. The readings will be compared to alarm thresholds and if required will transmit them.

Temperature transmission	This dictates if the temperature is transmitted along with the data using either GPRS or SMS
Antenna selection	You can choose between the internal antenna (default) and the use of an external antenna, using the SMA connector.
Modem power scheme	The modem that is built in to the Metron uses additional power – you can choose how the modem is configured when the unit is not transmitting. There are five options: 'Power off between transmit events' - modem will power down between transmit intervals. 'Always on (GPRS pollable when idle)' - modem will idle between transmit intervals and be pollable using GPRS. This should be used if GPRS communications are used and polling is required. 'Always on (SMS pollable when idle)' - modem will idle between transmit intervals and be pollable using SMS only. It should not be used if GPRS communications are used and polling is required. 'Transmit on power up' - modem will idle between transmit intervals and be pollable using SMS only, it also transmit upon power on. 'modem will idle between transmit intervals and be pollable using GPRS, it will also transmit upon power on. Unit autodetects if internal battery is used and will default to 'power off between transmit events' if this is the case to optimise battery life.
Read on wakeup	'Go to pin screen when any button pressed' – When a button is pressed to wake the unit up, the PIN number will be displayed. Pressing left will not activate anything. 'Read sensors if left button pressed' – After pressing a button to wake the unit up, you can then use the left button to read each of the sensors individually. It may be useful for allowing visibility of the reading without giving permission to change settings in the menu.
Data Formatting	Dictates the formatting of SMS messages sent. If sending to a mobile phone, use 'Human-readable text message' otherwise use 'Gateway'.

Input configuration

The inputs tab allows each input to be configured as an analogue or digital input. Channels 5 – 9 can only be configured as pulse or digital when there is a pulse count board plugged into the unit. For each type, the parameters are explained on the following pages.

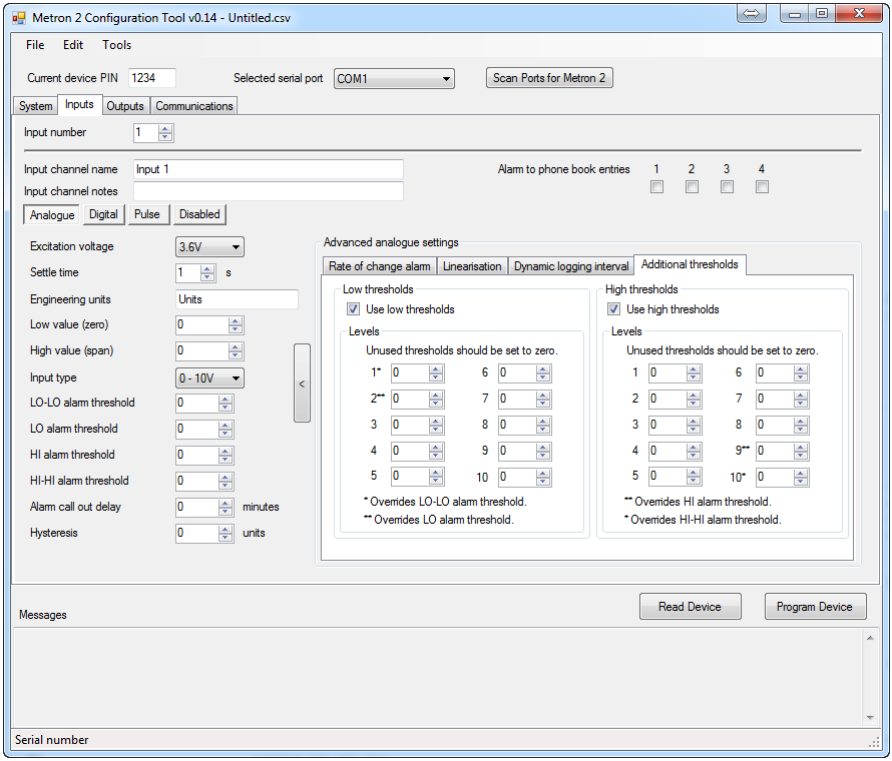


The common variables for each input, regardless of configuration are:

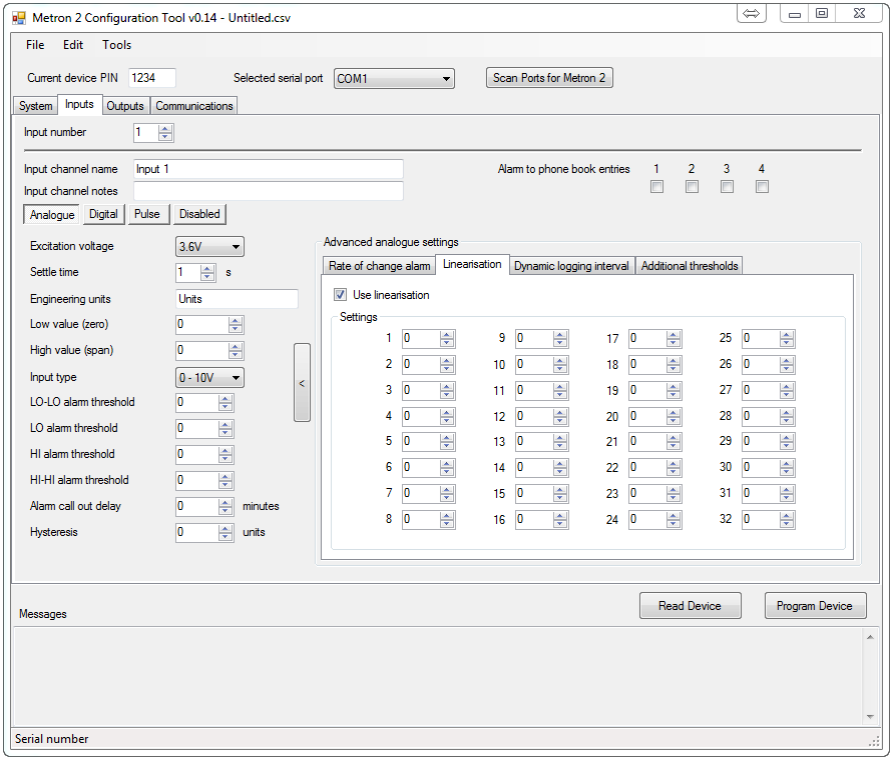
Option	What it does
Input channel name	A unique name for the channel that identifies what it connected to it, for example ‘pump house’
Input channel notes	This can be used to set any notes that may be useful for future use.
Alarm to phone book entries	These correspond to the phone numbers you can set under the ‘communications’ tab. If you tick a box, it will attempt to send a SMS message to the phone number you have selected when it transmits.

The variables that can be set for the Analogue channels are:

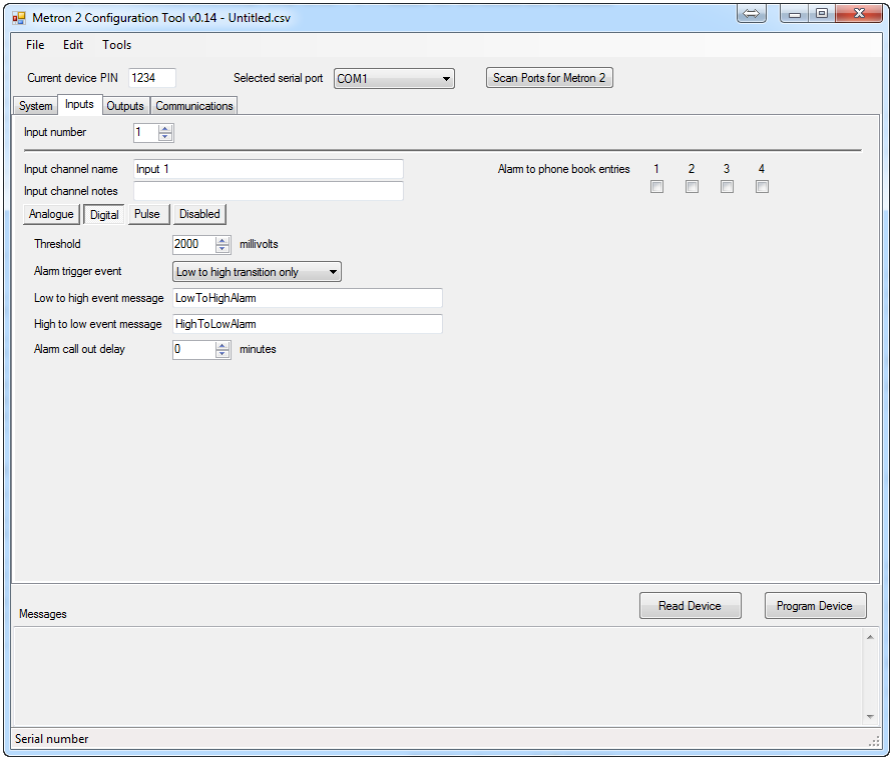
Option	What it does
Excitation voltage	The voltage that will be sent to the sensor channel +V connection when the sensor is being read. This can be 3.6V, 5V or 21.6V.
Settle time	The length of time the sensor is powered before the reading is taken. Longer times lead to shorter battery life.
Low value (zero)	Engineering value for low (zero) reading. Depending on configuration, this value will be used when the input is 0mA (when configured to 0-20mA), 4mA (when configured as 4-20mA) or 0V (when configured as 0-10V)
High Value (span)	Engineering value for high (zero) reading. Depending on configuration, this value will be used when the input is 20mA (when configured to 0-20mA or 4-20mA) or 10V (when configured as 0-10V)
Input type	Selects whether the input pin (IN connection) mode and scaling is set up for 0-10V, 4-20mA or 0-20mA
LO-LO alarm threshold	LOLO alarm value (can be overwritten by value1 of Command 3(l) – see section **Error! Reference source not found.** for more details)
LO alarm threshold	LO alarm value (can be overwritten by value2 of Command 3(l) – see section **Error! Reference source not found.** for details)
HI alarm threshold	HI alarm value (can be overwritten by value9 of Command 3(h) – see section **Error! Reference source not found.** for details)
HI-HI alarm threshold	HI alarm value (can be overwritten by value9 of Command 3(h) – see section **Error! Reference source not found.** for details)
Alarm call out delay	Callout delay (in minutes) – how long an alarm condition must occur for before the alarm is sent.
Hysteresis	This value, in the engineering units set creates a ‘window’ around each threshold set on the channel. It is used when you have a noisy input that may trigger a threshold multiple times if around a threshold value. It should be set to a value that is larger than the maximum ‘noise’ expected on the input. For example, sloshing in a water tank could be eliminated using this.



In total, there are 10 low thresholds (if the input goes from above a value to below a value) and 10 high thresholds (if the input goes from below a value to above a value). Two of each of these can be programmed without using the ‘Advanced analogue settings’ – these are the ‘LO-LO, LO, HI and HI-HI’ settings. If you would like more than two of each kind of threshold, up to 10 can be set by clicking on the advanced analogue settings button.



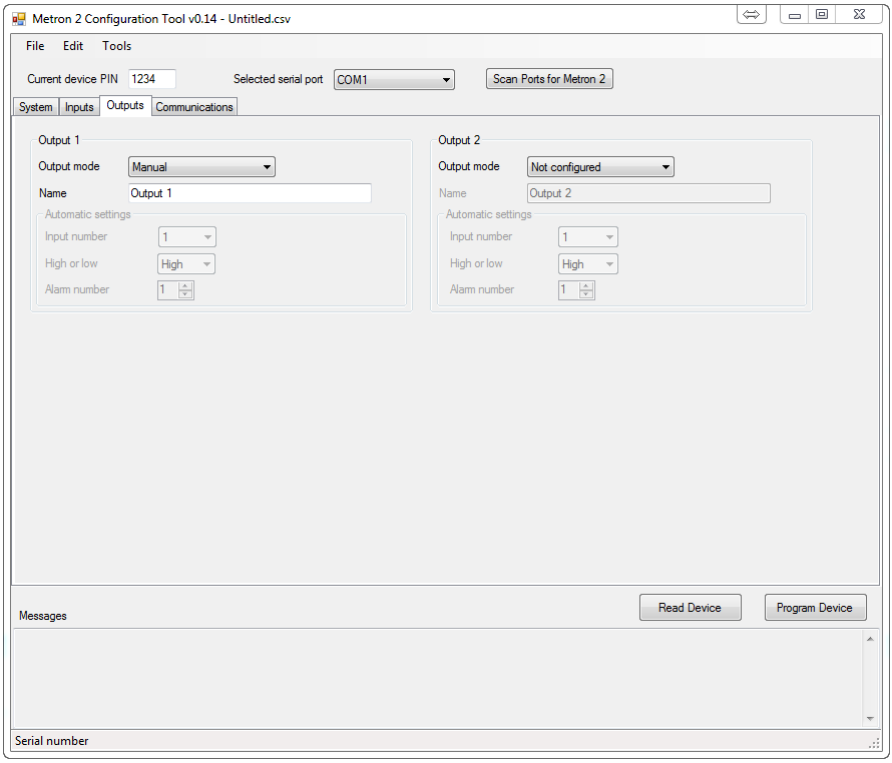
Linearisation should be used when the sensor reading against actual measurements is non-linear (for example, the storage containers shape changes area throughout its height)



The variables that can be set for the Digital channels are:

Option	What it does
Threshold	Threshold voltage, measured in millivolts – the example is 2.5V. On an expansion port any value other than 0 sets the threshold to 1 (ON)
Alarm Trigger Event	'Low to high transition only' – When an input goes from below the threshold to above the threshold, then it will trigger the alarm 'High to low transition only' – When an input goes from above the threshold to below the threshold, then it will trigger the alarm 'Any transition' – When an input crosses the threshold in any direction, it will trigger the alarm
Low to high event message	The text entered for this parameter will be displayed on the RTU when the input is in an ON (1) state. The RTU will transmit ON to the host system which then in turn will decide what to display to the remote user.
High to low event message	The text entered for this parameter will be displayed on the RTU when the input is in an OFF (0) state. The RTU will transmit OFF to the host system which then in turn will decide what to display to the remote user.
Alarm call out delay	Callout delay (in minutes)

Output configuration



The outputs can be run in two different modes:

1/ Manual – This is when each output is manually controlled. When in the mode, the only thing you have to set is the name of the output. The output can be controlled by sending the unit a text message:

PIN,[output name],ON,

Would switch the output on.

1234,[output name],OFF,

Would switch the output off.

2/ Automatic – You can program the unit to switch on and off the outputs by associating them with a specific threshold on an input.

Option	What it does
Input number	The input number of the threshold you wish to associate the output with
High or low	If the alarm that you wish to monitor is a ‘Hi alarm’ or ‘Lo alarm’
Alarm number	The number of the threshold that you wish for it to change state on.

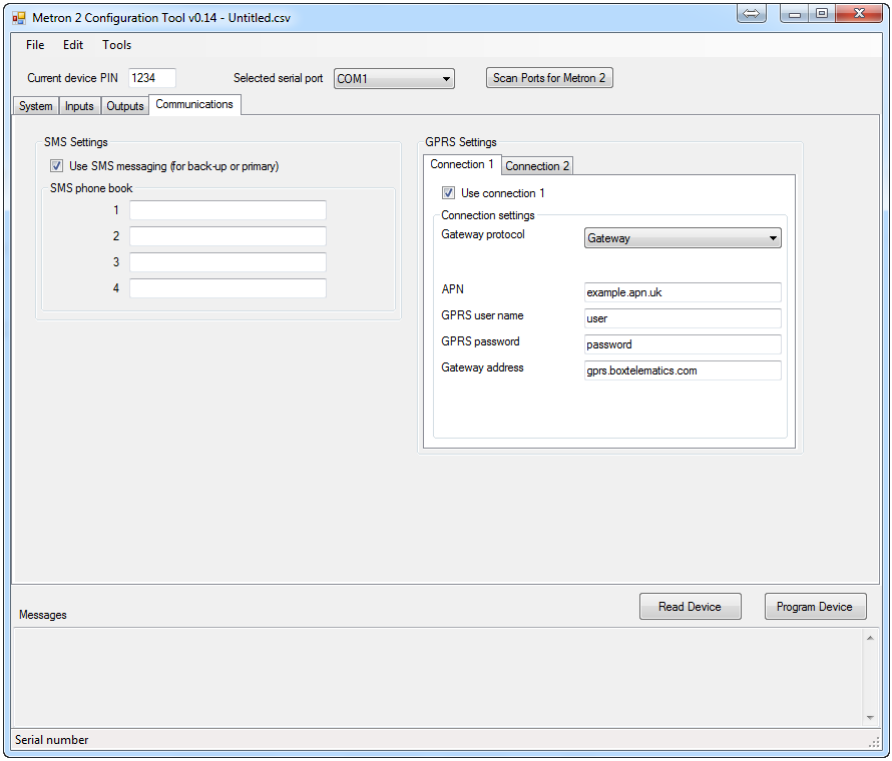
You can override the automatic control of an output by sending one of the manual commands to the unit. If you then wish to return it back to automatic, you can do this by sending:

1234,[output name],AUTO,

Would hand control back over to the threshold rule specified in [reference] if a rule has been configured.

When breaching the threshold the relay would be switched on, and then switched off when the alarm clears, following the rules configured for call out delay and hysteresis. The state of the relays can be manually overridden by sending one of the manual control commands, under this circumstance the threshold control is then switched off. The threshold control of the output can be switched back on by sending the AUTO command.

Communications configuration



The communications tab sets all of the options for communicating using SMS and GPRS.

Option	What it does
SMS settings phone book	Each of these can contain a phone number that can be used for communication. When you program an input, you can choose which of these phonebook entries to communicate to.
GPRS settings	You should tick the ‘Use connection’ box if you wish to use a GPRS connection.
Gateway protocol	You should set this to the protocol you wish to use ‘Gateway’: should be used with ‘SpotOn’ software ‘Bulk Protocol’: should be used with Metron View or compatible gateway ‘XML’: should be used with an XML compatible gateway

APN	Access point name. This should be provided by your SIM card provider. It will not work correctly without this being correct
GPRS user name	The username that was provided with your SIM card
GPRS password	The password that was provided with your SIM card
Gateway address	The web address or IP address of the server that you are attempting to contact. For example 24.24.24.24 or gprs.yourdomain.com

4.8.3 Driver Issues

Please refer to the troubleshooting section for more information (section 6)

4.8.4 Updating the firmware using USB

It is possible to update the firmware over USB. Unless there is a unknown bug or a new feature has been released, it is not advised to do this. Please contact Powelectrics for more information.

4.9 Important information

4.9.1 Decimal places and scaling

The Metron 2 is designed scale the input readings according to your high and low scales. These high and low scales can be set to the following limits:

Without decimal place: -999999 to +999999

With decimal place: Six numeric digits, plus an optional negative symbol and a decimal place. For example:

-0.00123
1234.00
-1.23456
99999.9

Are all valid numbers that can be used in the Metron 2.

4.9.2 Cell ID

The Cell ID is a unique identifier of the cell that the Metron is connected to. When the Metron is programmed to report the Cell ID, it will send this unique ID as channel 99, via SMS or GPRS. This code can be used to look up the location of the Cell that the Metron 2 is connected to, to give you an idea of its approximate location.

To look up the location using the Cell ID, we recommend you download a smartphone app to do this. One that we recommend (free) is iCell ID for iOS devices. You just need to enter the Cell ID into the app and it will load the location of the cell it is connected to.

4.10 Commissioning Guidelines

If you are installing a Metron on-site, it is critical that the following information is kept safely once complete:

- Location and site name
- The SIM card provider, IMSI number on the back of the SIM card and the phone number
- Any sensors connected, including part numbers
- Site contact information, if any.

It will help everybody tremendously if this information is available.

5 Example Configurations

5.1 How to calculate values for sensors

5.2 Example 1

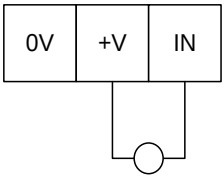
Four 4 – 20mA sensor, once per day transmit checking every 12 hours

Four analogue inputs, each 4-20mA

1234,1,+447111111111,
1234,2,Metron2_demo,12,0,0,359,359,1,0,0,0,0,0,0,
1234,3,1,a,tank1,2,2,litres,0,100,0,0,0,0,0,0,1,
1234,3,2,a,tank2,2,2,litres,0,100,0,0,0,0,0,0,1,
1234,3,3,a,tank3,2,2,litres,0,100,0,0,0,0,0,0,1,
1234,3,4,a,tank4,2,2,litres,0,100,0,0,0,0,0,0,1,

Change the phone number in the 1234,1,... command to your own. The unit will power the sensors every 6 hours and send the readings to you. Each sensor will be powered for 2 seconds at 21.6 volts.

Connect the 2 wires sensors to +V and IN.



5.3 Example 2

4 digital inputs, each volt free contacts

1234,1,+447111111111,
1234,2,Metron2_demo,12,0,0,1439,1,1,0,0,0,0,0,0,
1234,3,1,a,alarm1,1,1, ,0,100,0,20,0,40,0,0,0,
1234,3,2,a,alarm2,1,1, ,0,100,0,20,0,40,0,0,0,
1234,3,3,a,alarm3,1,1, ,0,100,0,20,0,40,0,0,0,
1234,3,4,a,alarm4,1,1, ,0,100,0,20,0,40,0,0,0,
1234,3,1,s,1,1,1,1,
1234,3,2,s,1,1,1,1,
1234,3,3,s,1,1,1,1,
1234,3,4,s,1,1,1,1,

Change the phone number in the 1234,1,... command to your own. You can add 3 more numbers if you like by using:-

1234,1,+447111111111,+447111111112,+447111111113,+447111111114,

Every minute the device will apply 5 volts to +V for each input (one at a time).

The device will send a text message once per day as a health check. To stop this change the '1439' in the 1234,2, command to '0'.

The inputs are configured as voltage, scaled 0 to 100 so when the circuit is made the input is read as 50.

For each channel there are 2 thresholds shown – a LOW alarm at 20, so when the circuit opens and the reading drops to 0 this alarm is breached and a text sent. There is also a HIGH alarm set at 40 so when the circuit is made the reading increases to 50 and this alarm is breached and a text message sent.

Connect the volt free contact to +V and IN.

6 Troubleshooting

6.1 Frequently Asked Questions

Why is my driver not installing?

If your computer fails to find the driver automatically, please follow the manual driver install process. It should prompt you to select a driver. Choose ‘manually select driver’ or ‘have disc’ (this will vary depending on operating system).

Why can’t I find the Metron 2 COM port?

The COM port should appear in device manager. If you do not see the COM port then you should instead see

The Metron 2 is appearing as the Metron ATEX in device manager, why?

The Metron 2 uses the same driver as the Metron ATEX. Because of this, it will appear as ‘Metron ATEX’

Why is my alarm not being triggered when it should?

Alarms are triggered when thresholds are crossed. Common reasons for no alarm triggering are:

- It has not yet had one wakeup interval (alarm becomes active after the first wakeup)
- The threshold has been programmed on the incorrect channel
- It has not actually crossed a threshold (check reading using ‘read now’)

Why is the progress bar stuck on 70%?

When it reaches 70%, it has connected to the network successfully and is trying to establish a connection to the remote server. Part of this include GPRS attach and context activation. These processes sometimes require a retry. Additionally the server may be unreachable if there are problems elsewhere. In general, it will take longer on the first few transmits. Please be patient as all of the previous described processes take time. If the unit cannot establish a connection it will fail and present an error to you.

Why is my pulse not being counted?

Pulses are only supported on the expansion card, channels 5 – 9. Please double check the wiring of the expansion card. Additionally, if you have set a pre-scaler, you will need to account for this when counting pulses.

My sensor is already fitted, powered and part of a 4-20mA loop.Can I still use it with the Metron2..?

Yes, wire to IN and 0V.

Can I fit the Metron2 in an explosive environment?

No – the Metron 2 needs to be mounted in a safe area and if you are connecting to sensors in potentially explosive areas you will need to use suitably approved barriers. Please do not proceed unless you understand the regulations surrounding explosive environment and electrical equipment.

I have no signal, what can I do..?

Move the unit or fit an external antenna. Make sure you are NOT using a 3G only SIM

Can Powelectrics help in supplying an external antenna..?

Yes – please contact us to discuss your requirements. If we do not have stock we can hopefully help by recommending a suitable supplier.

The connector on my external antenna is too big to fit through the gland on a Metron2. What can I do?

A standard SMA connector will not fit through the supplied M12 glands. We can supply a kit that allows an M16 gland to be fitted without drilling a new hole.

I want to mount my Metron2 inside a metal enclosure. Will it still work?

It may do. Some radio waves could pass through the metal but it will likely reduce the signal significantly. It is best to mount the unit outside the enclosure or use an external antenna.

I am using an AT&T SIM card in the USA – what should my ENS settings be?

AT&T have a set of features called ENS (Enhanced Network Services). By default this is disabled, but if for any reason you are using are having problems and using an AT&T SIM, you may want to change 'ENS State' (under System menu) to enable.

How do I find out what to put in the GPRS settings?

This depends on your SIM card and where you are sending your data. If you are using SIM cards or data collection services from Powelectrics then please contact us and we will provide you with the details. Generally your SIM provider will have the APN, username and password required.

What data collection options do you have to work with the Metron2?

You can send data either directly to your mobile phone or a computer. We have a hosted data collection service available as well as solutions for interfacing to SCADA systems. Please contact Powelectrics to discuss your requirements further.

Can I convert my Metron2/S to work from an integral battery?

No. Please contact us to discuss the options available to you.

Can I convert my Metron2/SSM to work from a power supply?

No. Please contact us to discuss the options available to you.

Do you have any options so I can run my Metron2 from a solar panel?

Yes – we have available some elegant, affordable and well proven solar options with intelligent charge regulators that maximise performance. Please contact us to discuss your requirements.

How do I know that the Metron has received a SMS message?

When the Metron 2 receives a text message, a letter icon will appear at the top of the screen followed by a double beep. This double beep indicates if the text message is in a valid format or not by having a higher pitch note first (invalid) or second (valid). An error will appear on the screen telling you about the problem if it is invalid.

6.2 Error messages

The messages that the unit can produce

Error	Details
Channel X disabled	You have attempted to access a channel that has not been configured.
Modem power up failure	The modem cannot power up. This may be because of a hardware problem or a power supply issue. Please contact us.
No response from modem.	The modem is failing to respond properly. Please contact us.
No GPRS or SMS settings configured	The settings required for the action you are taking have not been programmed or are incomplete.
Input not configured to phone book or bad phone book. Cancelled.	It is unable to send an SMS to the number that you have configured.
Unable to connect to network. Check SIM activation and Carrier Selection.	It is unable to connect to the carrier. You should check that the SIM is activated, the network is operating normally and you have a valid choice in 'Carrier Selection' selected.
Unable to send SMS, check signal strength and SIM credit	There was an error when attempting to send an SMS. This could be a very poor signal, a busy network, insufficient credit or the SIM may not allow sending of SMS messages.
Unable to get GPRS context activation. Check GPRS settings and/or try again.	It could not activate the GPRS function – you should double check all GPRS settings
Unable to get GPRS attach	It could not get a GPRS attach – you should double check all GPRS settings
Unable to connect to server, check GPRS address	It could not contact the server you have specified. This could be down to a server issue (not accessible) or something relating to web access from the SIM.
Unable to connect to server, check GPRS address and signal strength	As the above issue, except it has noticed that there is low signal strength.
Trying to get into polling mode. Not allowed.	Usually occurs when you attempt to go to 'Force Transmit', but the unit is attempting to enter polling mode. Please wait a little while until the 'P' icon has a box around it before retrying.

6.3 Other errors

When trying to diagnose problems, you may find it useful to enable ‘Display Errors’. You can enable this in the menu by going to System -> ‘Display Errors’ and choosing enable. When this is enabled, any problems that are encountered by the modem will be displayed on the screen too. The format of the message will be

‘X – please refer to manual’

When this message appears, it is coming directly from the modem. It should be self-explanatory, but if you would like more information, please contact us. The following errors can be found.

Errors	Errors (2)
phone failure	generic undocumented error
No connection to phone	wrong state
phone-adaptor link reserved	wrong mode
operation not allowed	context already activated
operation not supported	stack already active
PH-SIM PIN required	activation failed
SIM not inserted	context not opened
SIM PIN required	cannot setup socket
SIM PUK required	cannot resolve DN
SIM failure	time-out in opening socket
SIM busy	cannot open socket
SIM wrong	remote disconnected or time-out
incorrect password	connection failed
SIM PIN2 required	tx error
SIM PUK2 required	already listening
memory full	
invalid index	ok
not found	connect
memory failure	disconnect
text string too long	error
invalid characters in text string	wrong state
dial string too long	can not activate
invalid characters in dial string	can not resolve name
no network service	
network time-out	can not allocate control socket
network not allowed - emergency calls only	can not connect control socket
network personalization PIN required	bad or no response from server
network personalization PUK required	not connected
network subset personalization PIN required	already connected
	context down
network subset personalization PUK required	no photo available

service provider personalization PIN required	can not send photo
service provider personalization PUK required	
corporate personalization PIN required	generic undocumented error
corporate personalization PUK required	wrong state
	wrong mode
unknown	context already activated
	stack already active
Illegal MS (#3)*	activation failed
Illegal ME (#6)*	context not opened
GPRS service not allowed (#7)*	cannot setup socket
PLMN not allowed (#11)*	cannot resolve DN
Location area not allowed (#12)*	time-out in opening socket
Roaming not allowed in this location area (#13)*	cannot open socket
	remote disconnected or time-out
service option not supported (#32)*	connection failed
requested service option not subscribed (#33)*	tx error
service option temporarily out of order (#34)*	already listening
unspecified GPRS error	can not resume socket
PDP authentication failure	wrong APN
invalid mobile class	wrong PDP
	service not supported
Network survey error (No Carrier)*	QOS not accepted
Network survey error (Busy)*	NSAPI already used
Network survey error (Wrong request)*	LLC or SNDCP failure
Network survey error (Aborted)*	network reject